

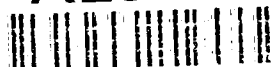


United States General Accounting Office

Report to the Chairman, Committee on Readiness, Congressional Budget Services, House of Representatives

# STRATEGIC AIR FORCE

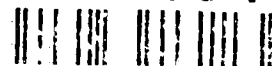
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## Further Efforts Could Be Taken to Extend Aircraft Service Life



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United States  
General Accounting Office  
Washington, D.C. 20548

National Security and  
International Affairs Division

B-257655

September 15, 1994

The Honorable Earl Hutto  
Chairman, Subcommittee on Readiness  
Committee on Armed Services  
House of Representatives

Dear Mr. Chairman:

Under the new national military strategy, the United States is reducing its forward presence, and the Department of Defense (DOD) must be able to rapidly deploy armed forces to any overseas location. This report responds to your request that we assess whether the current airlift aircraft, such as the C-5s and the C-141s, are being used in a way that conserves DOD's strategic airlift capabilities for wartime missions.

The U.S. Transportation Command is responsible for the peacetime and wartime mobility system, and its Air Mobility Command (AMC) provides the strategic airlift aircraft to fly the critical, early arriving troops and cargo for overseas deployments. The C-141, which has been the backbone of the airlift fleet, is nearing the end of its service life and has been under severe flight restrictions in recent years. The new airlift aircraft, the C-17, has had numerous technical problems and is behind schedule. Planned buys of it have been reduced. Thus, it is important to find ways to fly current strategic airlift aircraft less in peacetime in order to ensure their availability for wartime.

## Results in Brief

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In response to C-141 flight restrictions, AMC temporarily expanded the use of commercial and tanker aircraft for regularly scheduled cargo and passenger missions. It also plans to upgrade its strategic airlift simulator capability, which will allow it to reduce in-aircraft training.

However, AMC can do more. First, it can continue to use commercial and tanker aircraft to fly scheduled missions not requiring the unique capabilities of the C-141. Second, AMC can make maximum use of the upgraded simulators by transferring more of the air refueling and local proficiency training from the C-5 and the C-141. Moreover, it can institute a companion trainer aircraft program for the C-5 and C-141. That involves flying smaller, less-costly aircraft for training that does not require larger aircraft and would be similar to programs the Air Force already has and AMC has for tanker aircraft.

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As table 1 illustrates, these actions could extend the current estimated remaining life of the C-5 aircraft from 29.5 years to almost 41 years and the C-141 aircraft from 5.2 years to 8.4. These benefits will only be available for wartime use if the time saved is not used for additional peacetime flying.

**Table 1: Estimated Aircraft Service Life Increases From Using Commercial/Tanker Aircraft, Simulators, and Companion Trainers**

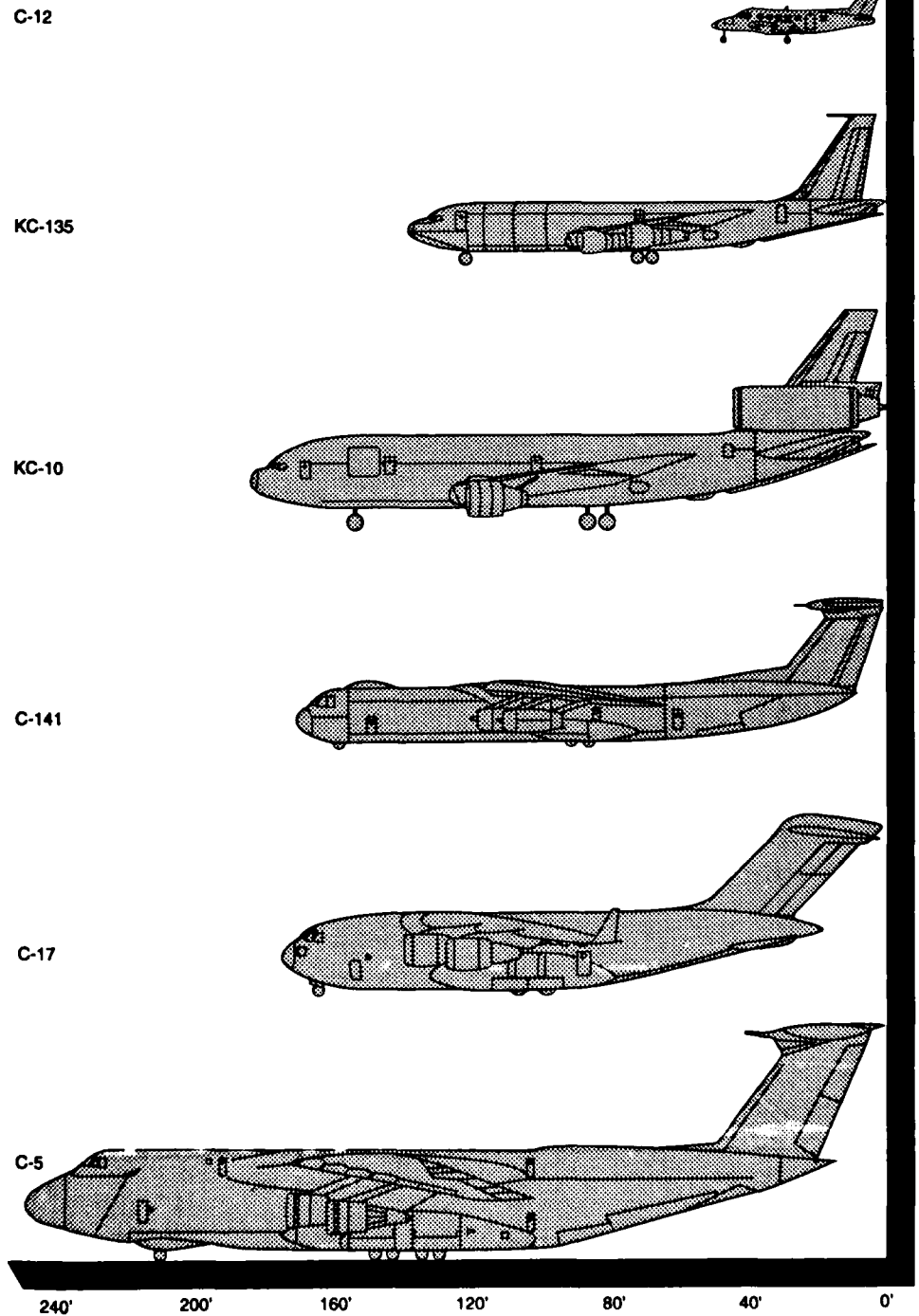
Aircraft	AMC estimated remaining life <sup>a</sup>	Added life through increased use of—			Our estimated remaining life
		Commercial and tanker aircraft	Simulators	Companion trainer aircraft	
C-5	29.5	0.0	7.4	3.8	40.7
C-141	5.2	1.4	0.7	1.1	8.4

<sup>a</sup>The point at which half the fleet reaches the end of its estimated service life. Data is in years.

## Background

AMC is responsible for providing global airlift services and air refueling operations. To carry out its mission, it has, as of June 30, 1994, a fleet of 70 C-5, 162 C-141, 38 KC-10, and 207 KC-135 aircraft. Its reserve components operate an additional 39 C-5s, 48 C-141s, and 248 KC-135s. AMC is just beginning to receive its newest airlift aircraft—the C-17. The C-5 aircraft, the largest airlifter, is capable of carrying 340 troops or 36 standard cargo pallets. The C-141, considerably smaller than the C-5, can carry 200 troops or 13 standard pallets. The KC-10 tanker aircraft is a military version of the DC-10 commercial aircraft. Although the KC-10 and KC-135 are primarily tanker aircraft used for air refueling, AMC has increasingly been using these aircraft in an airlift role since acquiring them from the former Strategic Air Command. The sizes of the various airlift, tanker, and companion trainer aircraft are shown in figure 1.

**Figure 1: Relative Size of Various  
Airlift, Tanker, and Companion Trainer  
Aircraft**



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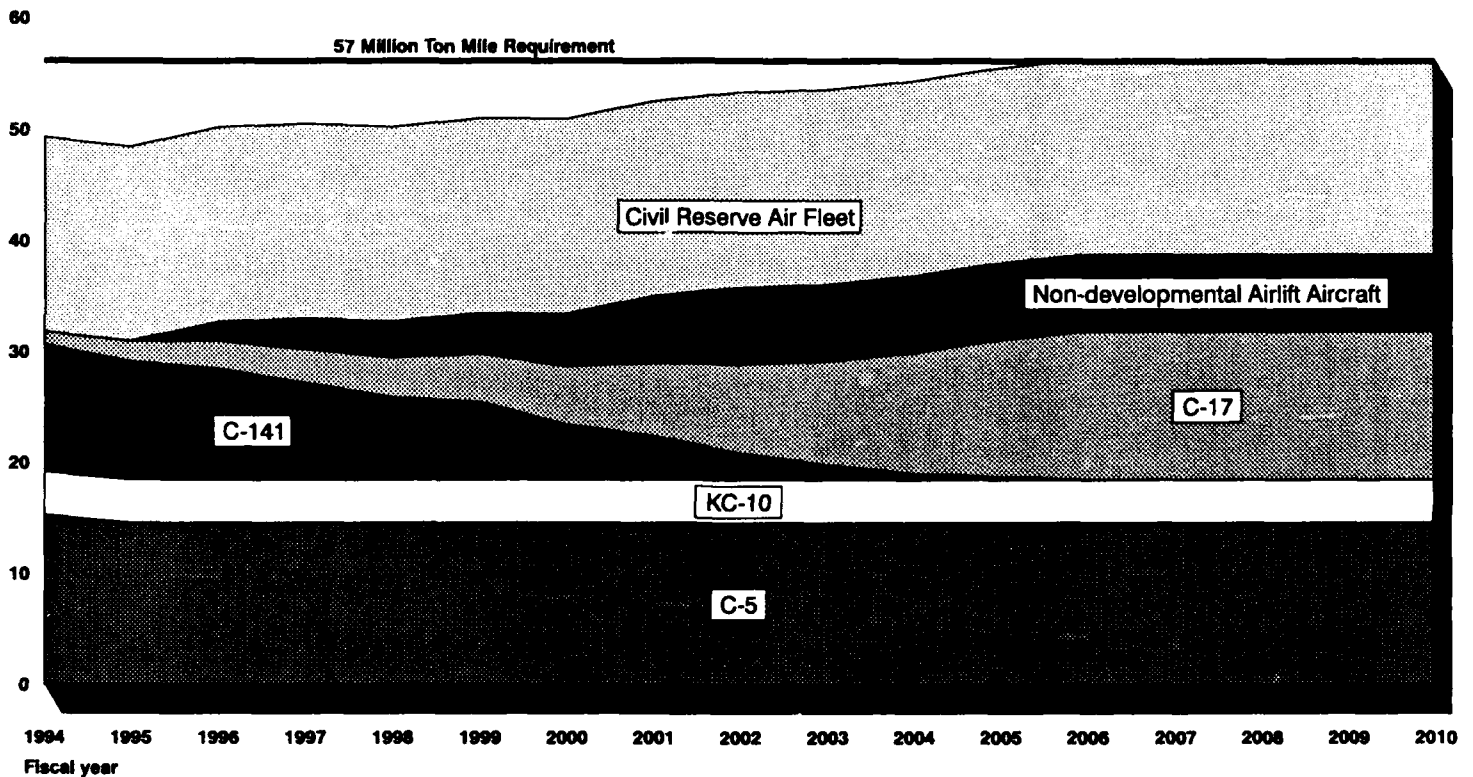
The current airlift capability is below the Transportation Command's requirement of 57 million ton miles per day for its most demanding planning scenario. The C-141, C-5, C-17, KC-10, and the commercial aircraft of the Civil Reserve Air Fleet (CRAF)<sup>1</sup> give DOD a current airlift capability of about 49 million ton miles per day. To achieve the airlift mobility requirement, the Air Force is acquiring C-17 aircraft and plans to acquire a nondevelopmental airlift aircraft beginning in 1996. Nondevelopmental aircraft could include new C-5s or commercial aircraft such as 747s or DC-10s. Under AMC's October 1993 Air Mobility Master Plan, which assumed procurement of 120 C-17 and 32 nondevelopmental aircraft, AMC would not achieve its required airlift capability until the year 2006, as shown in figure 2.

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<sup>1</sup>The CRAF program gives DOD access to commercial aircraft to augment military airlift during emergencies such as Operation Desert Storm.

Figure 2: Breakdown by Aircraft Type of the Strategic Airlift Capability Between Fiscal Years 1994 and 2010

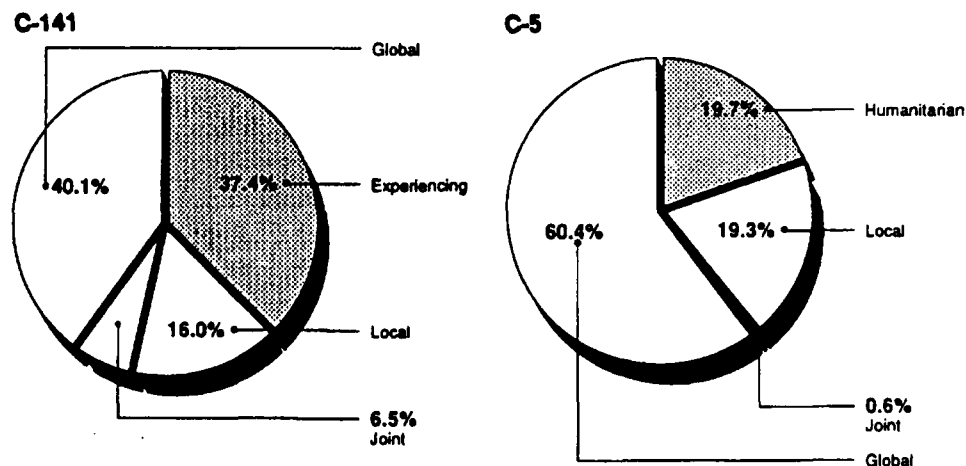
70 Million Ton-Miles/Day



The life expectancies of the C-5s and the C-141s are a function of the hours they fly. AMC's airlift flying hour program is centered around the number of peacetime hours its pilots and crews need to fly to be ready for war. Pilot training requirements are determined by (1) training events to maintain proficiency and (2) experience factors for new pilots who must progress from copilot to first pilot and then to aircraft commander.<sup>2</sup> Pilot training consists primarily of local, global, joint airborne, and experiencing training as shown in figure 3.

<sup>2</sup>Aircraft commander is the highest level of pilot proficiency.

**Figure 3: Breakdown in AMC's Fiscal Year 1994 C-141 and C-5 Training Program by Major Categories**



Local training includes proficiency, special operations, airdrop and air refueling training. In joint airborne training, pilots practice airdrop, assault, and aircraft loading in a multiservice environment. Global training consists of overseas missions for pilots to gain familiarity with foreign airports and air traffic control systems. The C-141 program includes experiencing training, which gives pilots the flying time to upgrade to aircraft commander. Because of its high flying hour costs and limited numbers of aircraft, the C-5 has generally not been used for experiencing pilots and its flying hour program includes no experiencing hours. However, the C-5 program includes flying hours for various humanitarian/contingency missions (such as Operation Restore Hope in Somalia) over and above normal training needs.

In addition to training, AMC uses its aircraft to haul passengers and cargo for customers such as the Army, the Navy, or the State Department. This flying serves AMC's training needs as well as customer needs. AMC also meets customer requirements by purchasing airlift from commercial carriers that have committed their aircraft and crews to the CRAF program to meet DOD wartime needs. AMC's peacetime purchases provide the incentive for continued commitment to the CRAF program.



## Commercial and Tanker Aircraft Satisfied Most Customer Requirements During C-141 Flight Restrictions

When the C-141 fleet was severely restricted in 1993, AMC was able to meet most of its regularly scheduled cargo and passenger deliveries by using more commercial capacity and tanker aircraft. If it continues to use these assets to a similar degree, AMC would extend the useful life of the C-141 fleet, thereby retaining it for wartime.

## Commercial and Tanker Aircraft Fly Regularly Scheduled Airlift Missions

AMC is using more commercial and tanker aircraft for scheduled service over established C-141 routes than it did in fiscal year 1993. AMC made this change primarily to ease the shortage of the C-141 aircraft that resulted from "weep hole" cracks in their inner wings. These cracks grounded many aircraft and required extensive repairs. Table 2 shows AMC's use of both commercial and tanker aircraft on regularly scheduled cargo missions from the United States in June 1993, before the C-141s were restricted, and in February 1994, when most of the fleet was grounded. The amount of cargo carried by commercial and tanker aircraft increased by about 70 percent, while the use of the C-141 decreased by about the same percentage.

**Table 2: Regularly Scheduled U.S. Cargo Business of Commercial, Tanker, C-141, and C-5 Aircraft**

Aircraft	June 1993		February 1994	
	Cargo (tons)	Percent of total	Cargo (tons)	Percent of total
Commercial	2,075	25	3,530	48
Tanker	486	6	725	10
C-141	2,148	26	607	8
C-5	3,280	41	2,380	33
Other	158	2	83	1
<b>Total</b>	<b>8,147</b>	<b>100</b>	<b>7,325</b>	<b>100</b>

## Limits Imposed on C-141 Flying Hours

Since 1981, the C-141 flying hour program has averaged about 1,100 hours per aircraft annually except during the Gulf War. In January 1994, the Commander, Transportation Command, directed that as the C-141s were repaired and returned to the system, they not be used on regularly scheduled missions as heavily as in the past. The directive limited use of the C-141 to instances specifically requiring capabilities that commercial aircraft could not provide, such as handling oversize cargo, and directed

AMC to use commercial and tanker aircraft instead. However, this directive covered only a 6-month period.

As of the end of fiscal year 1994, the C-141 fleet will have a median remaining service life of about 5.2 years, based on its historical flying hours. In addition to preserving the life of the aircraft, use of commercial flights whenever possible would provide more incentive for the commercial carriers to remain in the CRAF program. Continued use of commercial aircraft and tankers could extend the life of the C-141 fleet by about 1.4 years.<sup>3</sup>

Because of recent C-141 problems, coupled with multiple contingency and humanitarian operations, demand for AMC aircraft has often exceeded supply. Because of the heavy demand for airlift, AMC may use the C-141s to a greater extent as they are repaired and returned to the system. There are indications already that the C-141 is being used more, and both commercial and tanker aircraft less. For example, between February and March 1994 cargo tonnage moved by the C-141 on regularly scheduled routes increased from about 8 to 16 percent of the total, while commercial cargo tonnage decreased from 48 to 41 percent. In addition, on May 1, 1994, AMC directed that the C-141s replace the KC-135 tanker aircraft on Tanker Express West<sup>4</sup> for a temporary 3-month test period. After the test period, AMC may decide to permanently use the C-141s on these routes.

Several key carriers with substantial passenger capability have recently dropped out of the CRAF program, at least in part due to insufficient AMC business to justify the risk of future CRAF activations.<sup>5</sup> Additional AMC business, along with other incentives such as expanding the base of government business available to the CRAF carriers, could entice them back into the program and encourage others to remain.

## Flight Restriction Causes Training Problems

One problem AMC had when the C-141 fleet was restricted was that the C-141 flight crews had difficulty getting their scheduled training. AMC officials told us they took extraordinary measures to get the required minimum training hours. For example, in January 1994, when only

<sup>3</sup>This estimate is based on AMC's continuing to augment C-141 flights and flying them an average of 800 hours per year.

<sup>4</sup>AMC created Tanker Express West on July 1, 1993, using KC-135 tanker aircraft for daily missions of high priority cargo from the West Coast to Japan and Korea.

<sup>5</sup>See Military Airlift: Changes Underway to Ensure Continued Success of Civil Reserve Air Fleet (GAO/NSIAD-93-12, Dec. 31, 1992).

43 C-141 aircraft were available, AMC restricted use of half of them for training missions exclusively. This was the first time this had been done. AMC also sometimes assigned extra pilots to C-141 flights to try to get as many pilots as possible their required flight time. We believe that increased use of simulators and use of a new companion aircraft training program, as discussed in the following sections, could help ensure that C-141 crews get required training even when many aircraft are not flying.

## Increased Use of Simulators

A large body of research documents the economy and effectiveness of simulation. The commercial airline industry has steadily increased the use of simulators for required pilot training. Currently, most major airlines do 100 percent of their pilot proficiency training in simulators. The Federal Aviation Administration and commercial airline officials cite cost-effectiveness as well as improved safety and training as the primary reasons for transferring training to simulators. For example, emergency procedures can be practiced in simulators that cannot be done in an actual aircraft.

AMC recognizes the cost-effectiveness of transferring training to simulators and has proposed a simulator upgrade program for its airlift and tanker aircraft. AMC plans to implement the \$246-million program between fiscal years 1994 and 2001.

With the upgrades, AMC will initially use simulators for 25 percent of air refueling training and 50 percent of local proficiency training. As a result, service life is expected to increase by about 3.7 years for the C-5 and 0.4 years for the C-141, assuming that the saved hours are not used to fly other missions. If such missions are flown, however, the use of the simulator would still result in life extensions (1.5 years for the C-5 and 0.2 years for the C-141) because flights to move cargo are less stressful to the aircraft than some flights for training. AMC is projecting ultimate reductions in flying hour costs of \$265 million, resulting in savings of about \$19 million from the simulator upgrades. AMC's savings projections are based on estimated C-5, C-141, KC-10 and KC-135 flying hour savings for fiscal years 1994 through 2009.

AMC could move even more training to simulators within the simulator capacity available under the upgrade program and further increase aircraft service life. Our analysis indicates that enough total capacity will be available in the upgraded simulators to achieve 50 percent of air refueling training for both the C-5 and the C-141 aircraft, all C-5 local proficiency

training, and 50 percent of C-141 local proficiency training. AMC is planning to eventually transfer all local proficiency training to simulators, but is still conducting tests to determine what portion of the air refueling training could be effectively transferred. Under the expanded use of the upgraded simulators previously mentioned, AMC could extend the remaining service life of the C-5 aircraft by nearly 7.4 years, or about 25 percent of its remaining life, and the C-141 by about 0.7 years, or about 13 percent—assuming AMC does not replace saved training hours with other flying.

## Companion Trainer Aircraft

AMC could also reduce airlift flying hours and extend the remaining useful life of the C-5 and the C-141 aircraft by using a companion trainer aircraft to provide additional flying experience for new active duty flight school graduates. Such use could extend the C-5 life by about 3.8 years and the C-141 life by about 1.1 years.

The Air Force has long used small, inexpensive companion trainer aircraft to supplant flying hours in aircraft that are costly to operate. For example, in 1976 the former Strategic Air Command developed a companion trainer program to accelerate copilot upgrade to aircraft commander in bomber and tanker aircraft. Companion trainers have also been used for the F-117 fighter and reconnaissance aircraft, such as the U-2. Moreover, AMC presently operates a companion trainer program for its KC-10 and KC-135 tanker aircraft. New tanker pilots fly about a quarter of their flying hours each month in the C-12 trainer aircraft as they progress from copilot to aircraft commander. The C-12 flying hour cost is about \$275 versus about \$2,800 for the KC-10 and \$2,600 for the KC-135.

The C-141 flying hour program contains a large block of hours specifically for experiencing or seasoning new pilots so they will be skilled enough to progress from copilot to first pilot and then to aircraft commander. New C-141 pilots are programmed to fly about 20 hours per month for required training events. An additional 14 hours each month are programmed to gain experience. These hours—for new copilots to increase their pilot proficiency, judgment, and decision-making skills—could be performed in a companion trainer aircraft.

Each month AMC needs to provide about 150 C-141 pilots with 14 experiencing hours. If a companion trainer were used for these hours, as is common in other aircraft, about 25,000 C-141 hours annually could be

saved. This could extend the lives of the C-141 aircraft remaining as of September 30, 1994, by as much as 1.1 years.<sup>6</sup>

The C-5 flying hour program contains no specific amount of experiencing training because new pilots for the C-5 have historically transitioned from other aircraft. However, new C-5 pilots are now programmed to fly about 22 hours per month, with about 18 hours for required training events. This leaves 4 hours per month that are not specifically programmed for training events and that we believe could be done in a companion trainer. Each year AMC has about 110 pilots being trained to become aircraft commanders in the C-5 program. The use of a companion trainer for 4 hours per month by these pilots would save about 5,000 hours per year. These flying hour savings could extend the C-5's life by 3.8 years.<sup>7</sup>

As was the case with an increased use of simulators, AMC would only achieve the benefits from a companion trainer program if it does not replace the saved training hours with other flying.

We estimate that implementing a companion trainer program for airlift aircraft would require about 50 aircraft, based on AMC's experience with tanker aircraft companion training programs. Suitable aircraft may be available to support such a program. In its February 1993 roles and missions study, the Joint Chiefs of Staff reported that a number of the over 500 operational support aircraft, such as the C-12, were surplus to requirements and that more operational support aircraft were being bought. Operational support aircraft are typically suitable companion trainers and using some of these excess aircraft could preclude acquisition of new aircraft for the C-5 and the C-141 companion trainers. However, if aircraft must be bought, the Air Force estimates the C-12 acquisition cost at about \$2.1 million each.

## Recommendations

Because extending the service lives of the C-5 and the C-141 aircraft fleets during peacetime is critical to protecting DOD's strategic airlift capabilities for wartime, we recommend that the Secretary of Defense direct the Commander, U.S. Transportation Command, take the following actions:

<sup>6</sup>We calculated life extension by dividing flying hours possible to be saved by the number of average flying hours for each aircraft for the 3-year period 1993-95 and then multiplying the result by an average training severity factor. We then multiplied that result by the planes' average remaining service life. We used the following AMC C-141 data: average flying hours = 161,000, severity factor = 1.31, and estimated remaining service life (as of September 30, 1994) = 0.4 years.

<sup>7</sup>Life extension was calculated the same as for the C-141. The following AMC C-5 data were used: average flying hours = 47,000, severity factor = 1.23, and estimated remaining service life (as of September 30, 1995) = 29.5 years.

- Continue using commercial and tanker aircraft for regularly scheduled cargo missions by limiting the use of the C-141s to only those instances requiring its unique capabilities.
- Move as much as possible of the C-5 and the C-141 local proficiency training to the simulators when they are upgraded. In addition, increase the amount of the C-5 and the C-141 air refueling simulator training as soon as the current AMC simulator optimization study is completed, if the study concludes that such an increase is appropriate.
- Determine the cost-effectiveness of an airlifter companion trainer program to allow the C-141 and the C-5 pilots to accomplish many of their experiencing and proficiency training requirements in less expensive aircraft. This could include transferring available operational support aircraft from other DOD activities to AMC.
- Adjust future airlift flying hour program budget requests to reflect the shift between airlifters and commercial and tanker aircraft, and the C-141 and the C-5 flying hour reductions made possible by the increased use of simulators and companion trainers.

## Agency Comments

We provided a draft of this report to DOD for its review and discussed its contents with DOD officials. Although we did receive a draft of DOD's official comments on our draft report, DOD was not able to provide official written comments in time to be included in our final report.

DOD agreed with the general thrust of our report—reducing airlifter flying hours during peacetime will protect wartime capability. DOD also agreed that the C-5 and the C-141 aircraft service lives could be extended by increased use of simulators. DOD also agreed that aircraft service lives could be extended by establishing a companion trainer program, as we recommended in our draft report. However, officials told us that implementing such a program would probably require additional funding. DOD believes that assessing the costs and benefits of our draft recommendation, along with other initiatives, could maximize the benefit of the strategic airlift flying hour program. DOD believes, as does GAO, that such a study could conclude that a companion trainer investment would be justified given the potential of substantial aircraft service life extensions.

We revised our report to address most of DOD's specific concerns and we also revised our final recommendations to reflect their views.

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## Scope and Methodology

We interviewed various officials at these locations and reviewed pertinent regulations, guidance, and reports pertaining to the subject areas at the Air Mobility Command, Scott Air Force Base, Illinois. We also conducted audit work at the 60th Airlift Wing and 15th Air Force Headquarters, Travis Air Force Base, California. In particular, we reviewed 24 studies or reports by DOD and various independent sources on the use of simulators instead of aircraft.

We based our service life extension calculations on AMC's methodology using the median remaining service life for the C-5 and the C-141 aircraft, and aircraft stress factor reductions when specified training hours were removed from the aircraft. Among the assumptions we made, were that DOD's projected wartime airlift needs were valid and that AMC's projected pilot training and cargo delivery schedules were also valid.

We conducted our review from July 1993 through June 1994 in accordance with generally accepted government auditing standards.

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Copies of this report will be sent to the Chairman and Ranking Minority Members of the Senate Committee on Armed Services and the Senate and House Committees on Appropriations; the Secretaries of Defense, the Army, the Navy, and the Air Force; the Commandant of the Marine Corps; the Chairman of the Joint Chiefs of Staff; the Commander in Chief, U.S. Transportation Command; the Commander, AMC; the Director, Office of Management and Budget; and other interested parties. We will also make copies available to others on request.

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Please contact me at (202) 512-5140 if you or your staff have any questions concerning this report. Major contributors to this report are listed in appendix I.

Sincerely yours,

A handwritten signature in black ink, reading "Mark E. Gebicke". The signature is written in a cursive style with a large, stylized "M" and "G".

Mark E. Gebicke  
Director, Military Operations  
and Capabilities Issues





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